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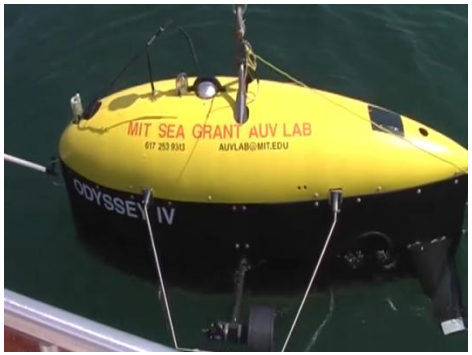

A Proposal for Robotic Entity Safety Release

NDIA 27th Annual National Test and Evaluation Conference

Presenter: Dr. Jeffery V. Mosley
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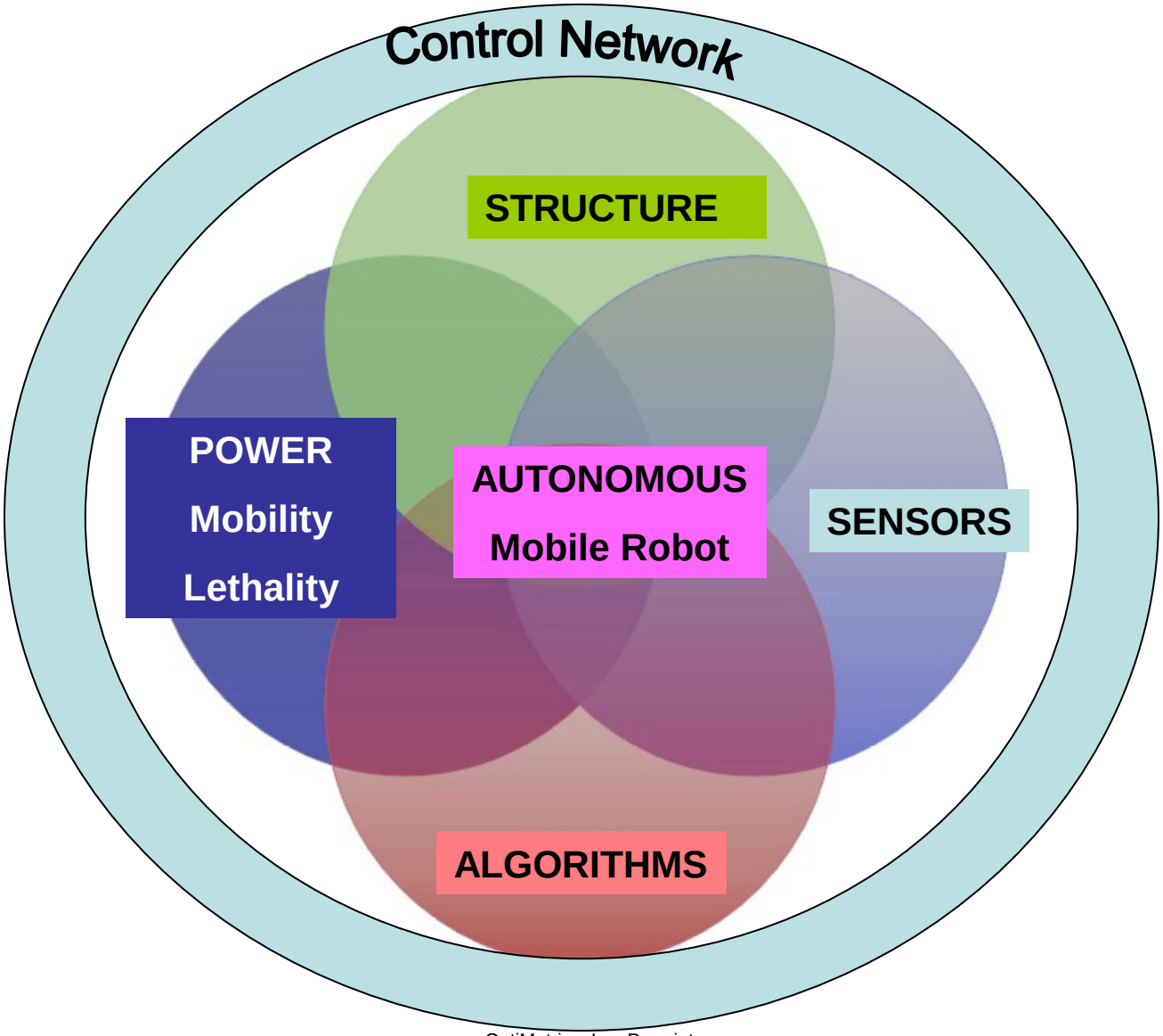
A Proposal for Robotic Entity Safety Release

Definitions



A Proposal for Robotic Entity Safety Release

Objective

- To reduce the high risk nature for the OSD T&E safety releases and confirmations involving collaborative and autonomous robotic missions for the Armed Forces
- Effective Risk Mitigation Requires Established:
  - Measures of Performance
  - Relevant COICS
  - Relevant KPPs
  - Relevant TPMs
  - Ability to Reliably Replicate the Intended Environment for use

Scope

There can be a process implemented where the affected Project Management offices, the Warfighter, and T&E organizations can utilize advanced simulation, component level testing, and iterative limited user testing to achieve the goal of a full safety confirmation for human and robotic collaborative operations.

Automate as much testing as possible to support T&E and PM and Warfighter requirements

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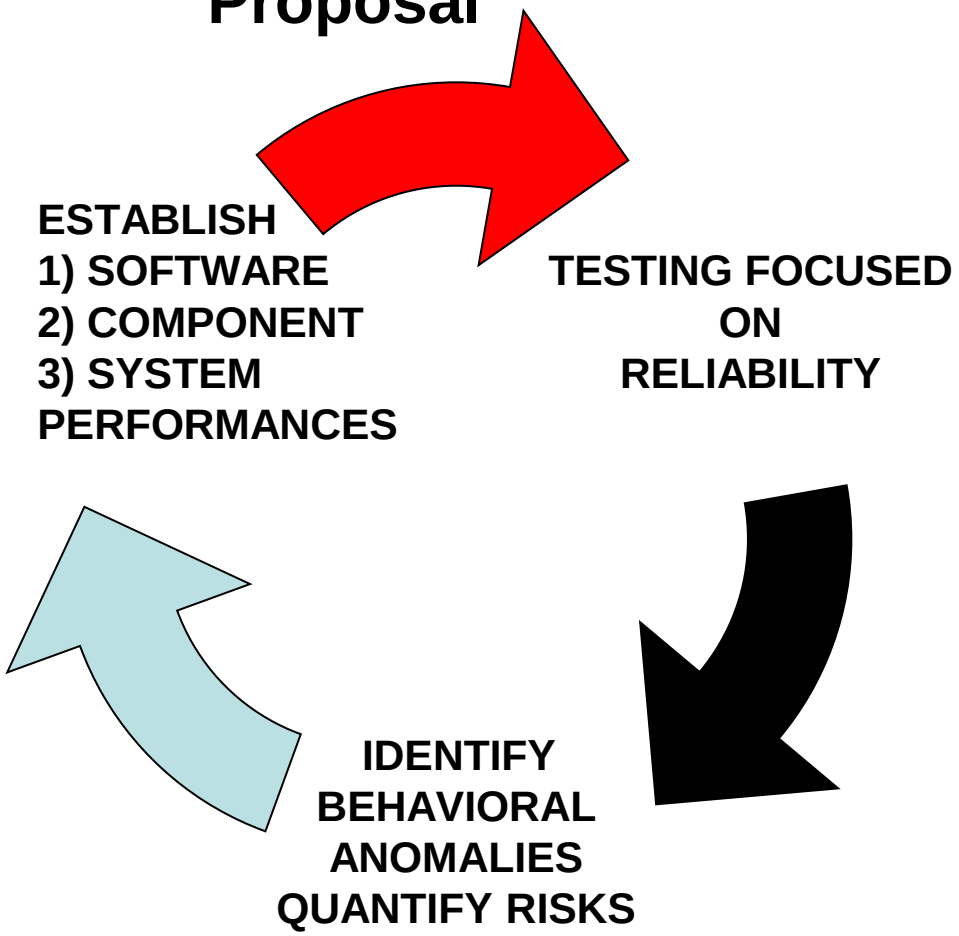
Proposal



The process not only establishes system performance, but supports system confidence and quantifies system reliability

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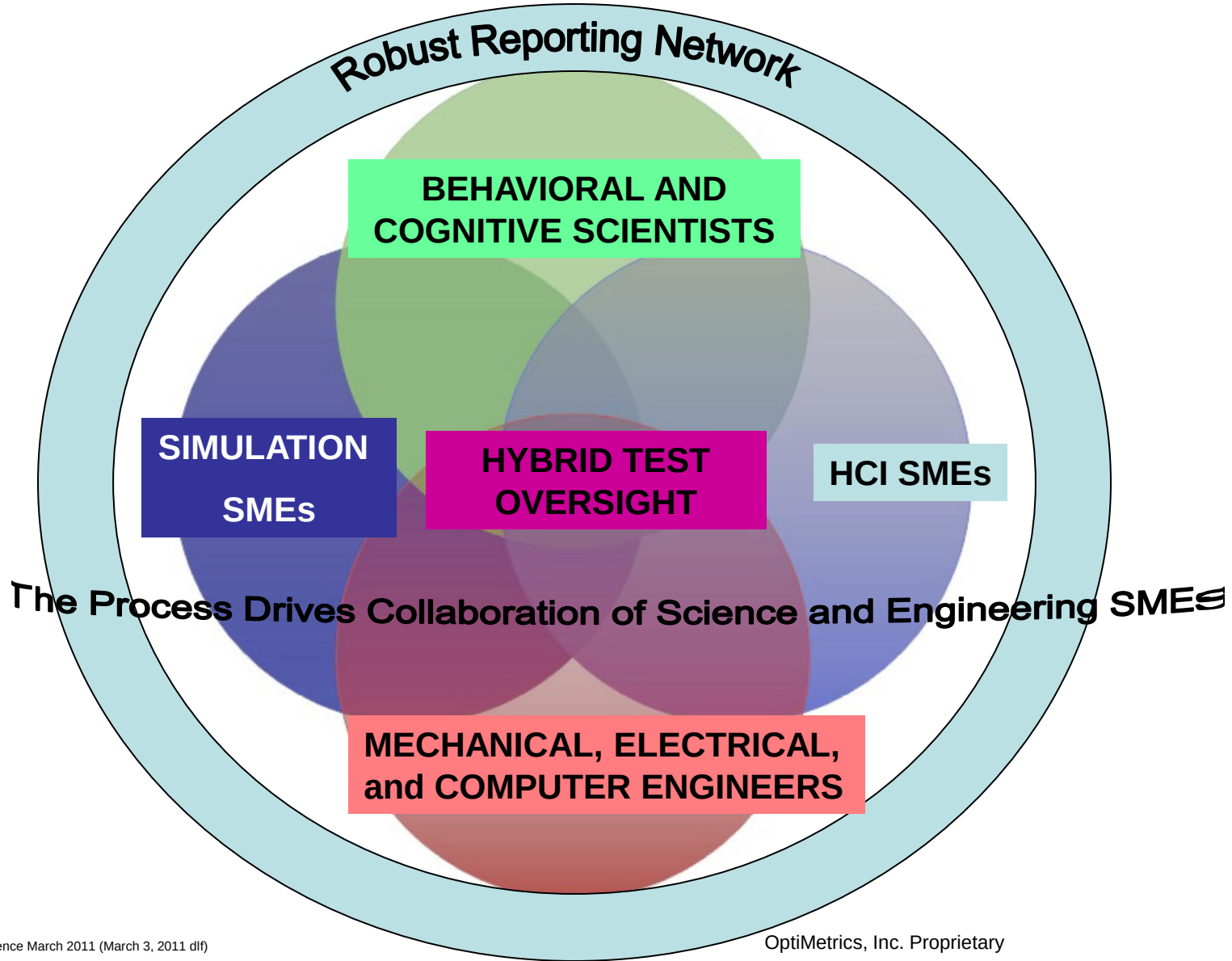
New Categories of Testers/Evaluators



Challenges

- Environment Accreditation
- Exponential Permutations in Software Code
- Potential for Concomitant Affects
- Potential for Critical System Bugs

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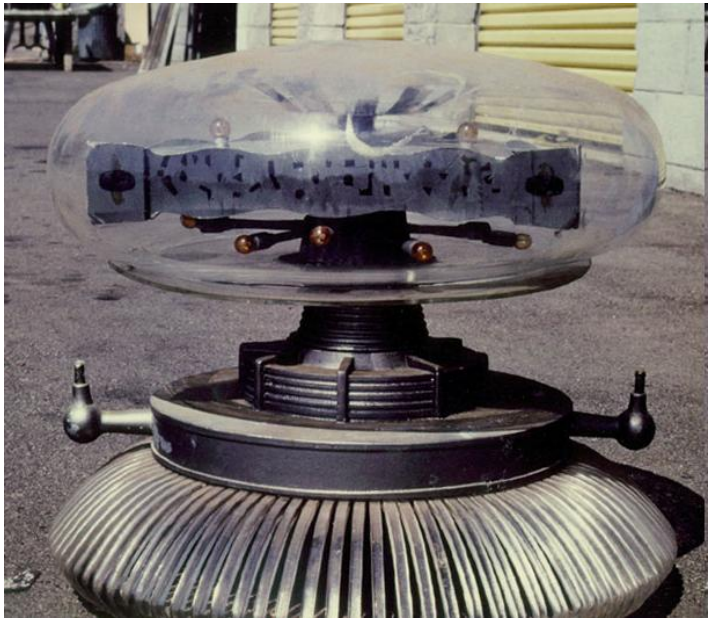
Software Cybernetics

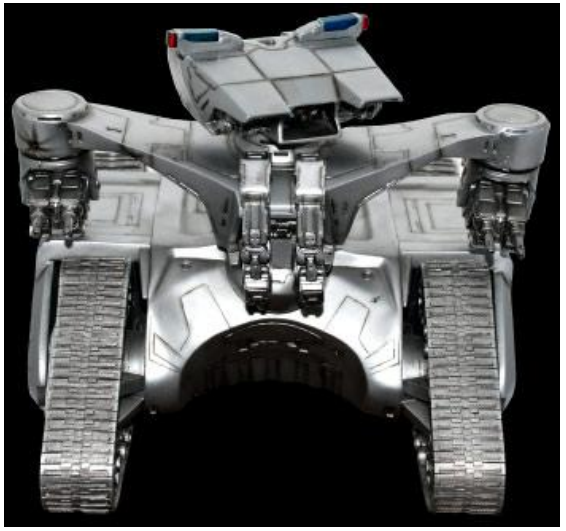
- T&E Scope
- Multi-dimensional Nature
- Potentially non-linear T&E
- Simultaneous and Conditional Channels of Information (increased I/O)
- Level of Cognition
- Open Questions



Developmental Testing

Successful Safety Testing for Release and Confirmation Leads to Acceptable Risk for Developmental Test

- Establish Performance Envelopes
- Assess Degraded States/Error Conditions
- Extrapolate Operational Profiles
- Test for Reliability as a Function of Capability
- Establish Risk of Action (Correct and Incorrect)
- Identify Failures Impacting Reliability of Operation



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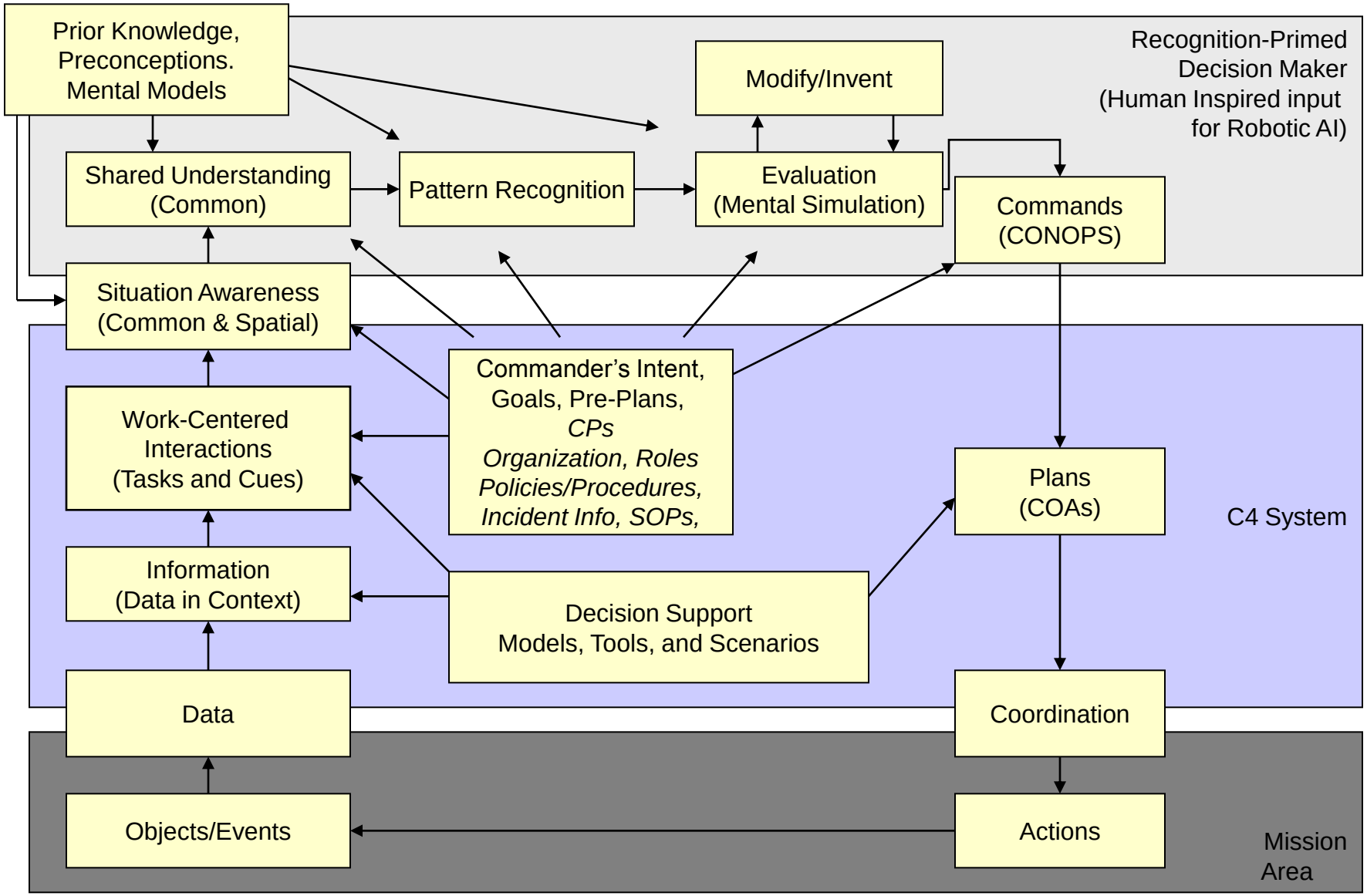
Something New

1) Assess Robotic Behavioral defects against their impacts on Performance baseline and successively more difficult test cases; Defects and anomalies are quantified to assess risk of failure or range of potential actions and their risks to mission reliability/success
2) The process begins with software and is continued for all system components and systems
3) The evaluation of the System of Systems is accomplished through repetition of mission environments
4) Outcomes establish mission norms and protocols for operation

Robotic behaviors will be synonymous with mechanical system function in the future

A Potential Schema for Robotic Development and Evaluation



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Operational Test/Usage Requirements

- Getting the Right Technology to the Warfighter
- Focused Operational Testing
- Allowing Conditional Autonomy
- Validation of Degraded States of Operation
- Trust and Confidence of Operation and Performance
- Error Tolerant Systems
- Ability to Adapt to Social Cues
- Ability to Operate in a Variety of Dynamic Environments

"Soldiers must be able to control autonomous systems to suite conditions as they change over time." (LTG Vane U.S. Army)

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New Tools

- Leverage of OGA Technology Rodeo and Challenge Events
- Adaptive Software Testing
- Use of Genetic Algorithms
- Enhanced Simulation Environments
- Development of Reality Arenas

The process will require multiple looks at the system under test

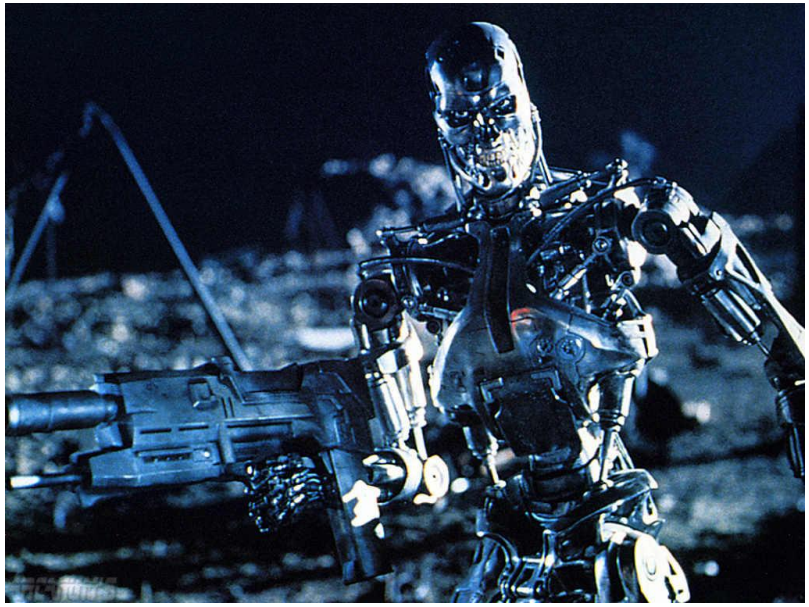
Outcome

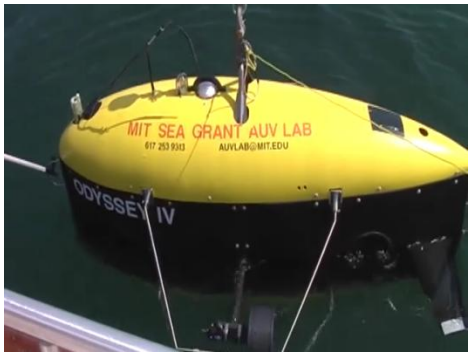
The OSD T&E community will have supported the development and institutionalization of a repeatable process and robust tools that can be re-used across many robotic platforms and potentially provided to robot vendors, and usable by the PMO for simulation based acquisition

We must plan now, how to evaluate the technology of tomorrow, today

Additional Considerations

- Interactive Training (Embedded) in Robotic Systems
- Robotic Puckstering
- Co-existence (social/work networking)
- Far-reach Maintenance Operations





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